Course Syllabus

Jump to Today Edit

BIOC 413: Experimental Molecular Biology

Syllabus Spring 2018

Class Meetings

Scheduled 1-5 pm, Anderson Biological Laboratories (ABL) 126; meets on Mon./Wed. for approximately half of the semester. Scheduled lab meetings are

- March 5 & 7, 19 & 21, 26 & 28
- April 2 & 4, 9 (last day of lab), 18 (Q/A Session)

INSTRUCTORS

Dr. Beth Beason-Abmayr (bbeason@rice.edu (mailto:bbeason@rice.edu)): ABL 326 (office) and 126 (lab); office hours are 10-12 MW or by appointment

This semester I will be conducting a study looking at teaching and learning. The purpose of this study is to determine the factors that influence teaching effectiveness and learning. Your participation in this study will last for the duration of the current semester and will entail activities no different from the regular activities you would otherwise engage in as part of the course. If you would like more information, please do not hesitate to ask. If you would like to opt out of the study, please talk to Dr. Beason as soon as possible.

COURSE OBJECTIVES AND LEARNING OUTCOMES

BIOC 413 further advances record keeping and technical communication skills that were emphasized in BIOC 311: Experimental Biosciences. This lab course requires greater independence than BIOC 311 and BIOC 313. You will apply strategies in molecular biology to investigate gene expression and function, with an emphasis on experimental design, data analysis, and data interpretation. You will gain experience in preparation of a scientific poster. **In this discovery-based course, students work in teams to complete part of a research project.** ***Overall learning goals and intended learning outcomes for the course are outlined below.***

Goal 1: Possess basic and advanced laboratory skills desired of an independent researcher

Understanding the rationale behind procedures and asking questions that reflect a willingness to learn promote effective time management and successful completion of experiments. Our best students are always the ones who are engaged in the learning process. An independent researcher

- follows standard protocols to complete specific procedures
- performs logical troubleshooting of laboratory procedures
- adheres to instructions on laboratory safety, and recognizes hazardous situations and acts appropriately
- uses and stores equipment properly
- handles lab reagents and solutions sensibly
- performs basic lab calculations to prepare solutions and samples for experiments
- measures and reports uncertain quantities with appropriate precision
- applies appropriate methods of analysis to raw data
- converts raw data to a physically meaningful form with appropriate units

Goal 2: Understand the importance of effective communication and of detailed and accurate record keeping

Communication and record keeping are fundamental to the dissemination of science. A student who is an effective communicator

- maintains a timely, comprehensive laboratory notebook with sufficient detail to repeat experiments, troubleshoot procedures, and analyze data
- shares information orally
- writes effectively in appropriate style and depth
- makes effective use of information resources

Goal 3: Recognize the importance of discipline and responsibility when working in a professional environment

In addition to working independently, each student is expected to work well with each member of a team. A mature and responsible student

- employs all available resources to prepare for laboratory work
- takes the initiative to note when assignments are due and completes them on time
- follows instructions for completion of assignments and execution of lab procedures
- works independently but seeks help when appropriate
- works effectively as part of a team and divides lab responsibilities to complete work in a timely manner
- admits when mistakes or errors are made and accepts responsibility for actions
- learns from mistakes as well as successes and is open to suggestions from teammates, TAs, or the instructor
- recalls routine procedures without having to consult a teammate, TA, or instructor
- takes the initiative to refresh past understanding of methods, procedures, explanations, and theory
- shares specific observations and experiences with teammates
- when necessary, picks up responsibilities if partner is unable to carry them out

Goal 4: Experience that not all scientific experiments work as planned

Many scientific experiments do not work as planned and often yield either no results or findings that conflict with or differ from previous experiments. Our teaching labs in BioSciences provide a "safe" and nurturing environment where a student can

- respond to questions that require troubleshooting of experimental methods or data collection
- use laboratory notes and observations to evaluate the success of experiments and identify potential errors when outcomes are unanticipated
- make corrections or alterations after missteps in experimental procedures, adjusting their schedule or research plan appropriately
- observe how other students report errors in posters or presentations

Goal 5: Recognize appropriate context and understand how to report meaningful data

Paying attention to detail is important not only in performing experimental procedures but also in reporting the results to the scientific community and the general public. A meticulous and focused student

- recognizes the relevance of data
- relates laboratory work to the bigger picture
- recognizes the applicability of scientific principles to real world situations
- considers how seemingly minor oversights or mistakes can have serious consequences

Goal 6: Integrate and apply knowledge/experience to current and future work

On the path to become a self-reliant critical thinker, problem solver, and communicator, a student progresses through several proficiency levels. A highly proficient student recognizes when the current skill level is not adequate to handle a particularly complex problem, and EFFECTIVELY seeks resources to acquire the needed skill. A student's present level of achievement and success is a reflection of past experiences and opportunities that have been made available as well as self-confidence. A successful student

- retains facts, methods, and principles learned in science and math courses and applies that information to another course, even in a different discipline
- uses critical thinking in the laboratory by making observations, drawing conclusions supported by the data, and acting upon those conclusions
- recognizes whether results and conclusions "make sense"
- figures out what "tools" to use when presented with a particular problem or task

AIMS of Lab: This capstone laboratory course is a true Project-Based Laboratory (PjBL), as modeled after the labs designed by Ann Saterbak, Ph.D., in the Bioengineering Department at Rice University: our "clients" will be BCB faculty and/or collaborators in the Houston Medical Center. Our clients will provide students with a source of RNA (e.g., cells or tissues) and specify either a new target gene for primer design or an existing target gene that needs troubleshooting. The timeline from target identification to product analysis will be from March to April. Over the course of approximately one month, student teams will isolate total RNA and synthesize cDNA and will attempt to design, validate, and optimize both gene-of-interest and normalizer

primer sets for qPCR using strategies that will help the protocol meet Minimum Information to Publish Q-PCR Experiments (MIQE) guidelines. At the end of the semester, deliverables include 1) laboratory notebook detailing primer design and the experimental approaches and 2) poster summarizing findings. Client's representative will meet with students at the beginning of the project to identify the target sequence specifications and provide cells or tissue for RNA isolation and may also elect to optionally meet with students at time of product delivery.

COURSE SCHEDULE (*tentative: subject to change; check often for updates):*

Lab	Discussion & Activities	Experimental Procedures
Day 1 Mar 5 **1 pm**	Course introduction **Eleven Golden Rules of Quantitative PCR.html** **FlyBase (http://flybase.org)** **Myc rRNA synthesis +supp.pdf**	Choosing a reference gene Choosing a gene of interest
Day 2 Mar 7	**Primer Design for PCR** • **BLAST (https://blast.ncbi.nlm.nih.gov/Blast.cgi)** • **Mfold (http://unafold.rna.albany.edu/?q=mfold/download-mfold)** • **Primer3 (http://bioinfo.ut.ee/primer3-0.4.0/)** Validation of primers	Primer design Begin exp. w/ Arabidopsis (4 weeks): wound; wait 3 h; collect/freeze tissue
Mar 12 &14	**SPRING BREAK**	**No meetings**
Day 3 Mar 19	Quantitative PCR (qPCR): **BioRad SsoAdvanced Universal SYBR Green Supermix Manual.pdf** Reverse transcription	qPCR temperature gradient Reverse transcription of RNA: **BioRad iScript Reverse Transcription Supermix for RT qPCR.pdf**

Day 4 Mar 21	Data analysis (temp. gradient qPCR) Test qPCR set-up: Master Mixes	Test qPCR: **BioRad SsoAdvanced Universal SYBR Green Supermix Manual.pdf**
Day 5 Mar 26	Test qPCR set-up: Division of labor Test qPCR	
Day 6 Mar 28	Preparing a Scientific Poster (see Poster Resources folder in Canvas Files)	Poster Critique
Days 7-8 Apr 2 & 4	Data analysis (test qPCR) Poster questions??	Data analysis Agarose gel (2%) of qPCR products
Days 9 Apr 9	Agarose gel analysis of RNA?? Data analysis continued... **Eleven Golden Rules of Quantitative PCR.html** Revisited	Agarose gel of RNA: **Qiagen_RNeasy Mini Handbook Excerpts.pdf**
Last Day Apr 18	Poster Q/A: Individual (ABL 329)	(none scheduled)

Required Text and Resources

- **Canvas**: modules, course videos, supplemental resources, pre-lab exercises and other assignments, announcements, grade postings, class calendar, and more
- *Writing Papers in the Biological Sciences*, Fifth Edition (2012) Victoria E. McMillan (Bedford/St. Martin's)

Required Materials

- Sharpie (extra fine point recommended)
- ballpoint pen
- safety GLASSES (NOT goggles)
- computer

Preparation

*In preparation for **class discussions**, everyone is expected to read appropriate background material* (articles are available in Canvas Resources). *Additionally, you must come to **lab** prepared*--this requires you to READ the experimental protocols BEFORE coming to lab, not just print a copy of them and bring it with you. You will be given any additional information in the pre-lab meetings.

For discussions:

- Read over assigned papers, course web site and any additional materials and identify any questions for the instructor
- Obtain necessary information about techniques from the resources provided
- Come to discussions prepared to answer questions and evaluate your knowledge about the techniques, safety issues, scientific theory, and experimental significance

For laboratory work:

- Read the rules for safe conduct in the laboratory before the first lab session and be aware of special safety concerns for each lab meeting
- Use resources to ensure that you know what we are doing and why we are doing it
- Prepare an outline (procedure, notes, calculations) so that you are ready to perform labwork
- Complete and submit online assignments by the specified due dates
- Record your prelaboratory calculations in your notebook when applicable

Follow-up work:

- Monitor assignment due dates each week to ensure that you are aware of upcoming assignments
- Check Canvas Announcements and email frequently for new or updated class information

NOTE: You are responsible for printing procedure information and additional resources for each day of lab (i.e., there are no handouts). Please see the course web site and Canvas for further details. Please bring your personal computer to discussion and lab with you.

ATTENDANCE POLICIES

Attendance at all class and laboratory meetings is required. Absences may be excused due to illness or unexpected/unavoidable emergencies; students are expected to contact the instructor as soon as possible in the event of an emergency. Make-up lab sessions are unable to be offered.

ASSIGNMENTS AND GRADING

All work is to be completed individually unless otherwise specified. You must your work as instructed in Canvas. **For full credit, all assignments must be submitted on time. The penalty for late assignments is 10% of the total score per 24-hour period past the deadline.** Due dates for assignments are listed in Canvas; these dates are subject to change. Do not ask for an individual extension to a due date because you have a paper due, or three exams, or your computer crashed; due dates are set so that you have plenty of time to complete your work. Don't wait until the night before to start - there is no penalty for starting early. ***It is your responsibility to plan ahead.***

Although in the real world there are often no excuses, you will be given a break on assignments due to

circumstances that are truly beyond your control. *Alternative due dates will be worked out with the instructor on an individual basis.* Here are examples of **permissible reasons for a late submission**:

- A *serious* illness (flu is serious - upset stomach or case of the sniffles is not) or accident
- A *serious* family emergency or death (you are on your honor here)
- Other unusual circumstances may count also. For example, if the university closes due to flooding on the date the work is due.

Reflections are submitted in Canvas in "Quizzes": although there is no time limit for completing these, you are allowed a single submission. Please check Canvas for the Release/Due Dates; you must submit your work during this time frame to get full credit.

Contributions of assignments to the final course grade are as follows:

Assignment Group	Weight (%)
Poster (Team)	35
Poster Q/A Session (Individual)	20
Laboratory Notebook (Team)	20
Class Participation & Laboratory Performance (Individual)	20
Reflections and Evaluations (Individual)	5

The final weighting for each category is subject to change at the discretion of the instructor; after all assignments have been graded, the instructor may change the weighting to raise final course grades.

Communication Instruction

Both written and oral communication are emphasized in this course. As a team, you will maintain a laboratory notebook to academic standards (see **Laboratory Notebook Guidelines.pdf** and **BIOC 413 Notebook Checklist.pdf**); your notebook will be graded at the end of the semester. Ongoing verbal communication with your teammates during lab is essential for promoting a strong team dynamic and critical for completing the procedures in lab and analyzing the data.

We intend to use the overall quality of the laboratory notebook and your specific notebook entries to evaluate your effort. Describe all procedures that you perform in sufficient detail to repeat the experiment

and record any raw data. Remember to describe any problems encountered or unexpected results. See and the for specific evaluation criteria. *Each team will maintain a single laboratory notebook - notebooks will be given to you on the first day of lab*:

- ***Each team member is expected to make daily entries in the notebook during each lab.*** *A single team member must not, for example, act as a recordkeeper by writing in the notebook while the others carry out the work.* You may want to take turns writing the *Objectives/Daily Summary* for each lab day. Take turns recording information during lab and initial at the end of each entry by a different member of the team. At the end of the session, remember to draw a line through any remaining blank spaces.
- When you finish for the day, record the time on the final page and draw a line through any remaining blank spaces.
- *It is absolutely critical that you record details such as WHO did WHAT (e.g., loading samples on the gel, setting up PCR, etc.) and LABELS on your samples.* You must have this information in your notebook to determine where a procedural error(s) occurred and to use the correct sample for that day's procedures.
- Remember, **do NOT "pre-write" objectives or methods in your notebook BEFORE you come to lab.**

As a team you will prepare a scientific poster (see **413Poster_Eval_form_Sp15.pdf**).

You are encouraged to make appointments with the peer consultants at the Center for Written, Oral, and Visual Communication (CWOVC) for your communication assignments in this course. These consultants do not proofread or edit your work, but they will provide feedback on topics such as the organization of your poster, the coherence of your argument, and appropriate format. NOTE: For this course you are NOT allowed to work with a consultant who is a biosciences major or to get any assistance with the content of the assignment. You can make an appointment at the Center's website: **cwovc.rice.edu (http://cwovc.rice.edu/)** . Please consult with Dr. Beason if you have any questions.

Evaluation of Performance

We expect students to follow explicit instructions and to recall and apply previous training to each new project. Puncutality, safe conduct in the laboratory, and efficient completion of responsibilities will enter into the evaluation of overall performance. Read about our expectations and performance criteria in **lab citizenship_2017.pdf**.

HONOR CODE POLICY

All students will be held to the standards of the Rice Honor Code, a code that you pledged to honor when you matriculated at this institution. Consult the Honor System Handbook at **http://honor.rice.edu/honor-system-handbook/ (http://honor.rice.edu/honor-system-handbook/)** for details about this code and how it is administered. This handbook outlines the University's expectations for the integrity of your academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process.

When you turn in an assignment, you must be able to make the statement, "On my honor, I have neither given nor received any unauthorized aid on this assignment." This pledge applies to notebook entries, pre-lab quizzes/exercises, homework assignments, section drafts, and the final paper. For detailed information, see the link on the course web site.

All pre-laboratory quizzes, homework, reflections, lab notebook, and writing assignments must represent your individual work unless specified otherwise. You will perform lab work as teams and are encouraged to share responsibilities of data collection and analysis. While you may discuss data calculations with teammates, when you begin working on the poster, you should not work together on or share ideas about specific information to include in text, formatting and/or content of figures and tables. The Writing Center's mentors may be consulted about the clarity and quality of your writing; however, those mentors should focus on your writing without providing comments about scientific content. Additional honor code details for written assignments are included with the assignment. The following applies to all written assignments: No one is to have access to any other student's paper for this course, from this semester or from any previous semester. When assignments are prepared by teams, no team is allowed access to another person's or another team's written assignment as described above. Thus, it is both a violation to provide or post material not provided by the instructor or to use similar material for your own benefit. If you find that previous papers are posted on the web, kept in college libraries, or available in any other form, please report the suspected violation to the honor council.

STUDENTS WITH DISABILITIES

Course material will be delivered either digitally (online or email) or in person and may be visual (written documents, slides, videos, etc.), audio (videos, presentations, discussions), or interactive (questions, discussions, clickers, etc.). Course work will require answering questions online, safely performing laboratory procedures, writing in lab notebooks, typing papers, reading written materials, discussing material with peers, and may include light lifting and sitting for extended periods of time. Some interactive portions of lectures will not be available online; thus, students should choose or request seating where they are best able to view and hear presented materials.

Any student with a documented or suspected disability needing academic adjustments or accommodations is requested to *contact the instructor in person or by email before the first day of class*; all discussions will remain confidential. Students with disabilities should also contact Alan Russell (**alan.g.russell@rice.edu (mailto:alan.g.russell@rice.edu)**), Director, Disability Support Services (713-348-5841) before the first day of class.

Information contained in this course syllabus, other than the absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.

Course Summary:

Date	Details	
Wed Jan 3, 2018	Poster Q/A Session (https://canvas.rice.edu/courses/9991/assignments/56567)	due by 1pm
Fri Jan 5, 2018	Lab Notebook (https://canvas.rice.edu/courses/9991/assignments/56566)	due by 4pm
Mon Jan 8, 2018	Scientific Poster (https://canvas.rice.edu/courses/9991/assignments/56568)	due by 11:59pm
Mon Mar 5, 2018	Reflection 1 (https://canvas.rice.edu/courses/9991/assignments/56562)	due by 12:30pm
Fri Apr 20, 2018	Peer Evaluation (https://canvas.rice.edu/courses/9991/assignments/56564)	due by 11:59pm
	Reflection 2 (https://canvas.rice.edu/courses/9991/assignments/56563)	due by 11:59pm
	Self Evaluation (https://canvas.rice.edu/courses/9991/assignments/68128)	due by 11:59pm
Wed May 2, 2018	The LCAS Survey (https://canvas.rice.edu/courses/9991/assignments/68129)	due by 11:59pm
	Evaluation of Individual Participation and Performance (https://canvas.rice.edu/courses/9991/assignments/56565)	